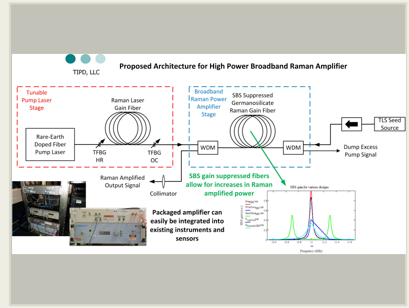
Small Business Innovation Research/Small Business Tech Transfer

Broadband Fiber Raman Power-Amplifier for Narrow Linewidth Tunable Seed Lasers Used in Spectroscopic Sensing, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

We propose an energy and space efficient high power continuous wave (cw) narrow linewidth broadband fiber Raman amplifier (FRA) with spectrally tunable multi-Watt-level average power output in the near and shortwave infrared (1080 – 2000 nm) that can be used in remote sensing systems on both atmospheric and terrestrial space-borne platforms. The all-fiber amplifier design concept for power amplification of a lower power commercially available tunable laser seed source (master oscillator) uses a single gain stage architecture based on germanosilicate (GeO_2-SiO_2) fibers specifically designed to suppress stimulated Brillouin scattering (SBS), one of the main factors limiting the maximum output power from narrow linewidth cw fiber amplifiers. The amplifier will be pumped by a fiber Raman laser whose spectral output can be tuned by compressive fiber Bragg grating technology. For this proposal TIPD will demonstrate power levels beyond what has been previously demonstrated for this technique, necessary for pumping the SBS suppressed gain fiber amplifier stage to its maximum potential output power. By implementing techniques for suppressing SBS in highly doped germanosilicate fibers it is anticipated that the amplifier wall-plug efficiency will reach 10%. In addition, the single gain stage architecture is compatible with distortion-free amplification of a phase/amplitude modulated seed source, useful for sensors that rely on sophisticated signal processing for detection. During Phase I, we will validate the broadband FRA proof-of-concept through modeling and benchtop demonstrations of both the power amplifier and tunable pump laser stages. Furthermore, appropriate designs for both the tunable laser source and SBS suppressed germanosilicate gain fibers will be formulated and assessed in terms of performance that best meets the target technical specifications for the FRA for a potential Phase II effort.



Broadband Fiber Raman Power-Amplifier for Narrow Linewidth Tunable Seed Lasers Used in Spectroscopic Sensing Project Image

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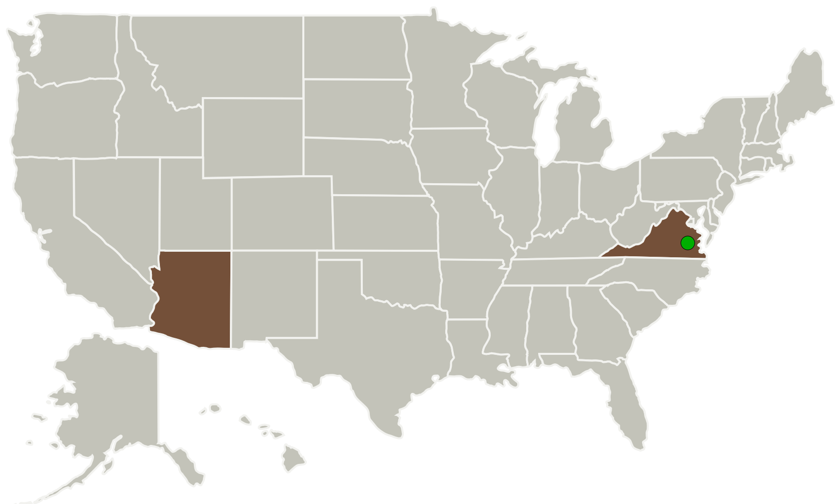
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
TIPD, LLC	Lead Organization	Industry	Tucson, Arizona
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Arizona	Virginia

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137778)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TIPD, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

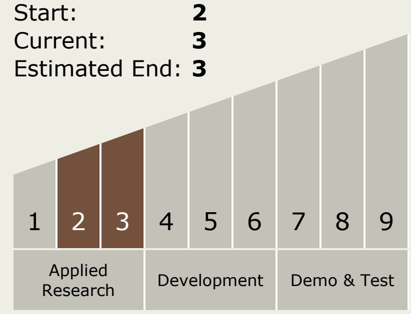
Carlos Torrez

Principal Investigator:

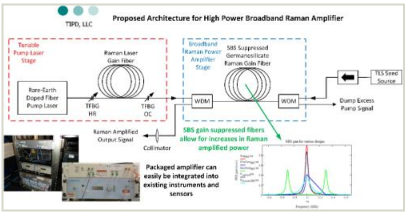
Valery Temyanko

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Images



Project Image
Broadband Fiber Raman Power-Amplifier for Narrow Linewidth Tunable Seed Lasers Used in Spectroscopic Sensing Project Image
(https://techport.nasa.gov/image/129860)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  └ TX08.3 In-Situ Instruments and Sensors
    └ TX08.3.1 Field and Particle Detectors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System